CAPACITIVE PROXIMITY SENSORS AND SOLUTIONS

STEDHAM ELECTRONICS CORPORATION

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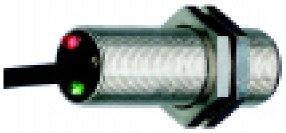


Applications and General Information

Definition

Simply expressed, a capacitive proximity sensor is a solid-state, high speed, non-contact switch.

Why use Capacitive Proximity Sensors

- longer life and reliability compared to an electromechanical switch
- high switching rate and rapid response
- ability to handle low current
- sealed construction permits use with presence of fluids, dust, and oil
- non-contact: will not damage the target
- when target movement is too precise for a mechanical switch
- when a target must be sensed through glass, plastic, rubber or paper
- electronic control and bounce free signal

Typical Applications

- conveyors
- robotics
- jam protection
- positioning
- parts detection or control
- indexing
- bottle cap or can lid detection
- counting
- broken or damaged tool detection
- liquid level control
- volume level control
- leak detection
- void or jam control
- semiconductor manufacturing
- food processing
- missing component detection
- bottle filling
- bottle detection
- thickness monitoring
- gaming table chip monitoring
- missing unit in shipping carton detection
- bin level in silo detection
- low paper roll monitoring

Ver 9/98

What's Inside

About Our Company pg 2
Capacitive Sensor Operating Principle pg 3
Selection Guide pg 4
Mounting Instructions pg 5
Sensing Distance Adjustment pg 5
Accessories pg 6
About Our Part Numbers pg 7
Warranty pg 8
Binary Output Capacitive Sensors pg 9
Analog Output Capacitive Sensors pg 29

Visit our Web-Site (http://www.stedham.com) for updated product information, including pricing and new product releases! Our on-line trouble-shooting guide is available for easy 24 hours/day access.

Vision Statement

Stedham Electronics Corporation will be a leader in creating and providing sensing systems which surpass even those found in nature.

Mission Statement

In our area of current expertise, capacitive proximity sensors and solutions, we will continue to:

- provide our standard product line with high quality and short lead times;
- provide custom solutions with the highest quality through innovation and by utilizing the most modern technologies available, and;
- maintain our customer base by the excellent long-term performance of our products and by providing the very best in customer service and product support.

Through these efforts, we will continue expanding our technical know-how and expertise into new sensing technologies, thus increasing our product and customer base.

We will achieve our vision by continually remaining on the leading edge of new technology, for the simple reason we like it. It's fun.

Goals

We are a privately held growth oriented company of engineering professionals focused and dedicated to achieving our vision. In this endeavor we have set several goals:

- Unmatched Product Quality
- Extremely High Customer Satisfaction
- Short Lead Times
- Competitive Pricing
- Expanded Customer Base for both standard products and Custom Solutions
- New "Infill" Products
- Totally New Product Technologies
- Ever Expanding R&D Efforts

Capacitive Proximity Sensors

Operating Principle

A capacitor is a two terminal device that consists of two conducting bodies separated by a non conducting (dielectric) material. A simple capacitor consisting of two plates is shown in **Figure 1**. A simplified expression for the capacitance of this arrangement is:

Capacitance, C = (a*ε)÷d

To create a more usable geometry for sensors the plates (or electrodes) can be arrayed in a variety of ways. Though this complicates the above expression for capacitance, the overall relationship between the variables remains the same. In **Figure 2**, the electrodes are arrayed on the same plane. In this way the electric field is projected away from the electrodes.

If the dielectric remains constant, the capacitance also remains constant. If the dielectric changes, the capacitance naturally also changes.

In capacitive proximity sensors, these two electrodes are coupled together, and integrated in a high frequency oscillator. In the "no target" state the oscillator is tuned to be resting. As a target enters the electric field, increasing the capacitance, oscillation begins. When the amplitude reaches a high enough level, a change in signal state is triggered.

Two main families of electrode configurations are utilized for standard applications, commonly (and incorrectly) classified by most manufacturers as SHIELDED and UNSHIELDED, which reflects more the flush-mountability rather than operating principle. In actuality, the difference lies in the number of electrodes provided:

Dielectric Type (D-Type) capacitive proximity sensors are configured as shown above, with a **two** electrode couple integrated in the oscillator. Entrance of **any object** will increase the dielectric and therefore, the capacitance, resulting in oscillation. Such sensors will detect all materials, insulative or conductive.

Conductive Type (L-Type) capacitive proximity sensors are configured with only **one** electrode integrated with the oscillator. Entrance of a conductive material into the field supplies the second coupling electrode which then causes oscillation. Such sensors are excellent for "looking through" an insulative material such as rubber, glass or paper in order to detect a conductive material such as water, or metal.

Figure 1

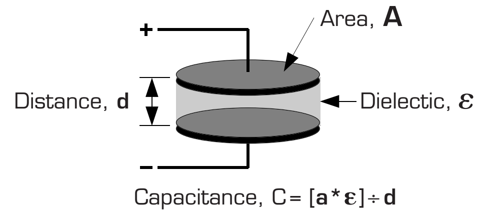
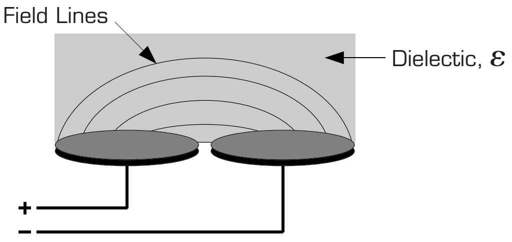


Figure 2



Stedham Electronics also includes a compensating electrode in all capacitive prox products. This electrode is coupled with the sensing electrode and also integrated into the oscillator. It is designed to detect contaminating elements only, and if present, to compensate their effect away so that they are ignored, avoiding false triggering.

The ability of any electrode configuration to sense great distances is a function of the material being sensed. Sensing conductive materials results in the maximum sensing distance capabilities of any capacitive proximity sensor.

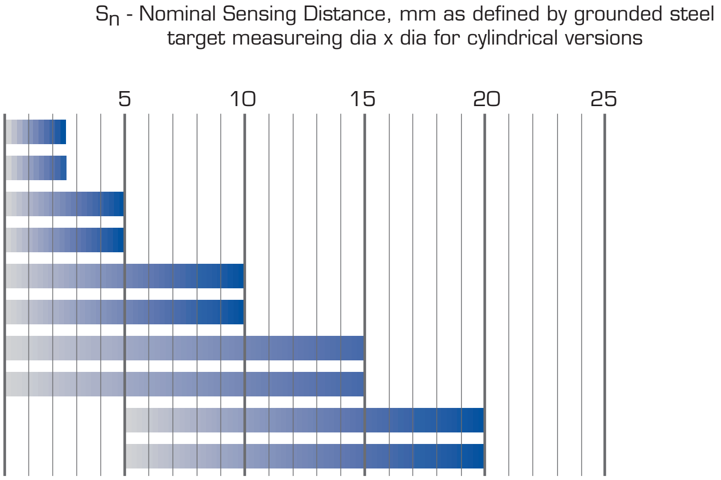
The sensing capabilities for dielectric materials is a function of the dielectric constant of the material and the mass of material within the sensing field. A sensing distance reduction factor needs to be applied to such materials.

Please refer to the Selection Guide for further assistance or call us for application help.

Capacitive Proximity Sensors - Selection Guide

Figure 1

Sensor	Type	Rush Mountable
M 12mm	D-Type Metal	Yes
Cylindrical	L-Type Plastic	No
M 18mm	D-Type Metal	Yes
Cylindrical	L-Type Plastic	No
M 30mm	D-Type Metal	Yes
Cylindrical	L-Type Plastic	No
32 mm	D-Type Metal	Yes
Cylindrical	L-Type Plastic	No
FLATPACK	D-Type Plastic	No
30x45mm	L-Type Plastic	No



Generally, selection of the proper proximity sensor is controlled by one of two criteria: the available space in which to insert the sensor, and/or; the sensing distance required of the sensor. Then follows selecting the sensor which will provide the proper outputs, etc.

Figure 1 shows the sensor size verses nominal sensing distance capability of Stedham Electronics capacitive proximity sensors. The nominal sensing distance is defined by using a square 1mm thick earth grounded steel target measuring dia x dia for cylindrical sensors, and equivalent to the size of the electrode for FlatPack versions.

The sensing capability of all capacitive proximity sensors is maximized with conductive, grounded targets (metal, water, etc). Other non-conductive (dielectric) targets (plastics, dry wood and paper, glass, etc) are sensed at reduced distances.

Determination of the proper reduction factor is required to assure that the sensor size needed can supply the required sensing distance. This is possible utilizing the table in **Figure 2**. This table, based on tests in our laboratory, should indicate worst case sensing distances. Performance in the field should be better. On-site testing is the best method, once it is established that a certain product will probably yield the desired results.

Please call us if you need further help selecting and/or setting up your sensor.

Figure 2

Material	Reduction Factor
Alcohol groups, liquid	0.35
Ammonia, liquid	0.25
Cardboard, thick	0.15
Cardboard, thin	Direct Contact
Cement, powder	0.10
Cereals	0.10
Concrete, cured	0.75
Concrete, slurry	0.90
Flour, power	0.10
Gasoline	0.20
Glass	0.25
Marble	0.50
Oil, liquid	0.15
Paper	0.15
Plastic, pellets	0.15
Porcelain	0.20
Salt	0.15
Steel, Ungrounded	0.90
Steel, Grounded	1.00
Sugar	0.10
Water, Fresh	1.00
Wood, Dry	0.50
Wood, Wet	0.75

Capacitive Proximity Sensors - Mounting and Adjustment

Mounting

Stedham Electronics has all mounting brackets and accessories required for standard installations (See Accessories). Should you have special requirements we will be happy to provide custom solutions and application help.

D-Type sensors with metal housings may be flush mounted. The mounting distance between two or more flush mounted sensors should be the diameter of the sensing face to prevent "cross-talk" interference.

Sensors with plastic housings require an area of free space around the sensing face. The face of the sensor should be positioned from the mounting surface a distance equivalent to the diameter of the sensor (see Figure 1). Such sensors may be mounted as close as two diameters (on center) to one another to prevent "cross-talk" interference.

When sensors are facing each other, they should be no closer than 8 times the sensing distance (See Figure 2).

On cable versions, Stedham Electronics provides tinned wire ends. If you need to trim the cable, please tin the wire ends to assure proper connection.

Care should be taken to assure that the target does not strike the sensor. Care should also be taken to assure that excessive dust, shavings, chips, liquids, etc. can not collect directly on the sensor face or in the sensing field.

Connecting cables may be run in conduit with other control wiring. **Never run DC connecting cables in conduit containing AC power wiring!**

Figure 1, Plastic Housed Sensor Isolation Requirements

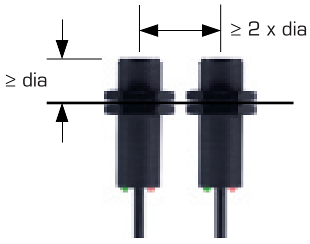
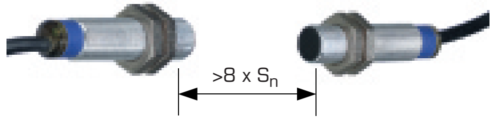
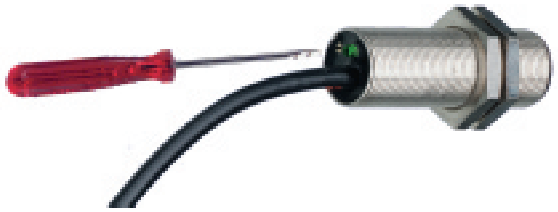


Figure 2, General Isolation Requirements (Face to Face)



Sensing Distance Adjustment



Most of Stedham Electronics capacitive proximity sensors are equipped with an adjustment potentiometer located near the cable entrance. By rotating the potentiometer in the **clockwise direction** the sensing distance is **increased**. For convenience, each sensor so equipped is provided with a small screw driver for this purpose.

Apply power to the sensor and place the target at the desired detection point. If the sensor is detecting the target, reduce the sensitivity until it no longer detects it. Then adjust the potentiometer until is just detects the target. Then add an appropriate safety factor **(see note)** by rotating the potentiometer more in the clockwise direction.

Achieving usable sensing distances up to $1.25*S_n$ may be possible, however, degradation of the performance specifications (hysteresis and repeatability) may occur.

The nominal sensing distance (S_n) is defined by using a square 1mm thick earth grounded steel test-target measuring dia x dia for cylindrical sensors. After setting the sensor for your application and target material, you should check the sensor using such a target. If the steel test-target is detected at a distance greater than $1.25 \times S_n$ the sensor should be mounted closer to the actual target if possible, and the sensing distance readjusted.

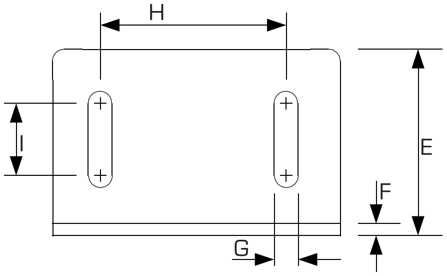
Note

The safety factor varies for each application and is a function of several variables such as: target material, desired sensing distance, environmental conditions and variability, etc. By increasing the sensitivity past the point where the sensor just detects the target, the above factors are eliminated from causing false triggers. However, the sensitivity can inadvertently be increased so much that the sensor detects the target too early or is unintentionally influenced by nearby objects. Determination of the safety factor is therefore best carried out on site.

Please call us if you need further help setting up your sensor.

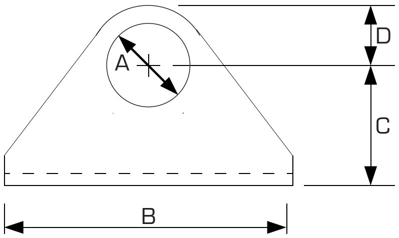
Accessories

Mounting Brackets for Threaded Cylindrical Sensors



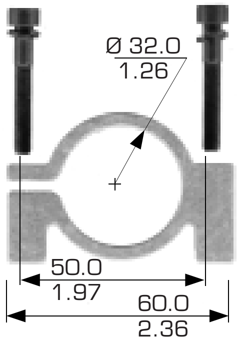
Top View

Sensor	Part No.		A	B	C	D	E	F	G	H	I
12mm	BR12M	mm	12.5	36.0	18.0	12.0	50.0	1.6	6.0	24.0	25.0
		in	.49"	1.42"	.71"	.47"	1.97"	.06"	.24"	.94"	.98"
18mm	BR18M	mm	18.5	54.0	27.0	18.0	50.0	1.6	6.0	36.0	25.0
		in	.73"	2.13"	1.06"	.71"	1.97"	.06"	.24"	1.42"	.98"
30mm	BR30M	mm	30.5	90.0	45.0	30.0	50.0	2.4	7.0	60.0	25.0
		in	1.20"	3.54"	1.77"	1.18"	1.97"	.09"	.28"	2.36"	.98"



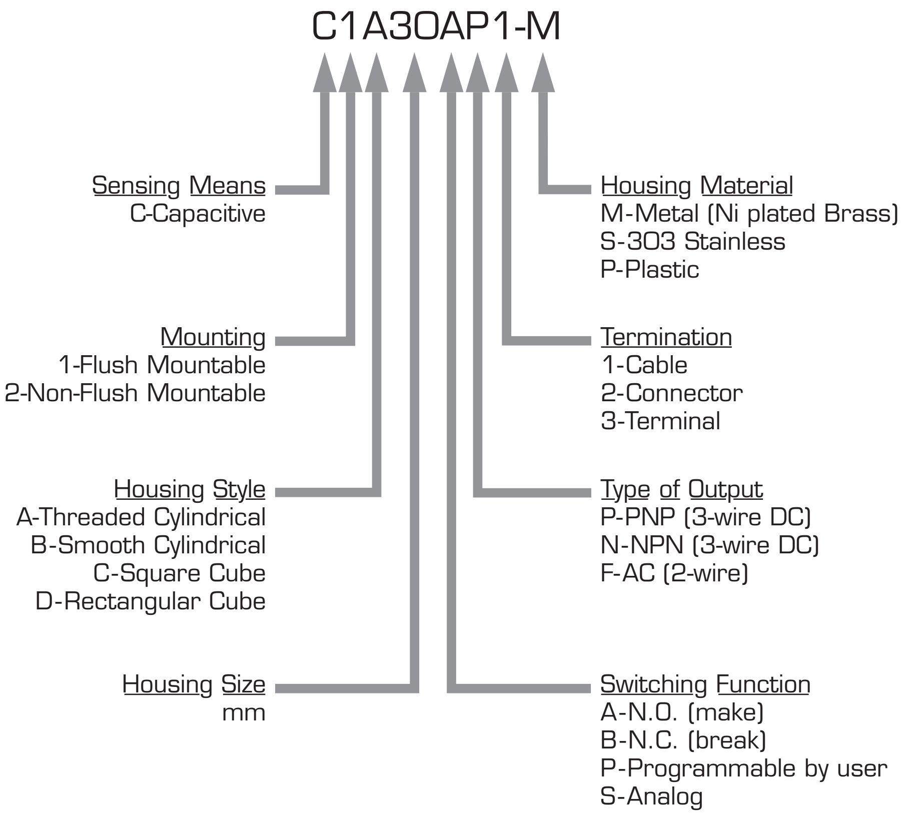
Front View

Mounting Bracket for 32mm Smooth Case Cylindrical Sensors



Part No. BR32M

About our Part Numbers



C1A30AP1-M

Sensing Means
C-Capacitive

Mounting
1-Flush Mountable
2-Non-Flush Mountable

Housing Style
A-Threaded Cylindrical
B-Smooth Cylindrical
C-Square Cube
D-Rectangular Cube

Housing Size
mm

Housing Material
M-Metal (Ni plated Brass)
S-303 Stainless
P-Plastic

Termination
1-Cable
2-Connector
3-Terminal

Type of Output
P-PNP (3-wire DC)
N-NPN (3-wire DC)
F-AC (2-wire)

Switching Function
A-N.O. (make)
B-N.C. (break)
P-Programmable by user
S-Analog

Device Classifications

In an effort to provide the fastest deliveries possible, Stedham Electronics has classified its part numbers into three categories: Preferred Products, Current Products, and Obsolete Products.

Preferred Products are generally in stock items with next day delivery possible. High market demand is the normal mode for a part number to be classified as preferred. Since product runs and stocking levels can be planned, the price of Preferred Products is also less. It may be possible that inventory is depleted due to greater than anticipated demand, however, if this is the case, a one week delay is all that should be encountered.

Current Products are products that may not be in stock. If this is the case, a two week lead time is standard. For orders of less than 100 pieces, the price for Current Products is higher.

Obsolete Products are products which have reached the end of their life cycles, however, existing demand is still present. Stedham Electronics will not stop producing a product needed by a customer, however, we strongly recommend substitution as quickly as possible. The price of these products is higher and the lead time is longer.

Legend of Device Classifications

C1A30AP1-M	Preferred Product
C2A30AP1-M	Current Product
(C2AB32AP1-M)	Obsolete Product

Warranty

Stedham Electronics Corporation warrants that its products will be free from defects in materials and workmanship for a period of 18 months after the date of delivery. Such failed products returned at Buyers expense within this period will be repaired or replaced. This warranty is in lieu of and excluding any implied warranty of merchantability or fitness for a particular purpose. This warranty is the sole and exclusive remedy. Stedham Electronics Corporation will not be liable for any other damages, either direct or indirect, incidental or consequential, or as a result of Buyers's misuse or negligence of the products.

While we provide application assistance personally and through our literature and Web-Site, it is up to the customer to determine the suitability of the product in the application.

Binary Output

Capacitive Proximity Sensors

M 12mm

Pages 11-12

0-2.5mm Range

M 18mm

Pages 13-16

0-8mm Range

M 30mm

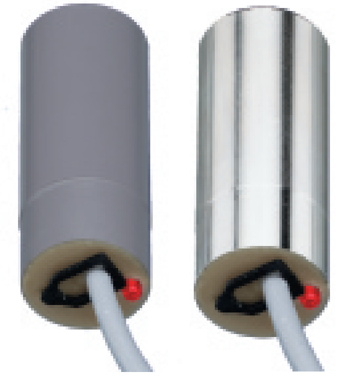
Pages 17-20

0-15mm Range

Ø 32mm

Pages 21-24

0-20mm Range



FlatPack

Pages 25-28

5-25mm Range

For Application Help Call Toll Free 877-STEDHAM

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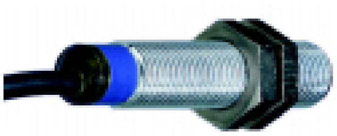
Notes

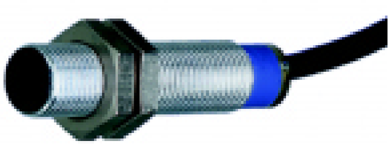
DC Capacitive Proximity Sensors

12mm Diameter Threaded Cylindrical

Features

- Small size for compact applications
- Sealed to IP67
- Short circuit, overload and reverse polarity protection
- -25 to +70°C (-13 to 158°F)
- Signal LED Indicator





Part Numbers

	Sensor Type		D-Type*
	Flush Mountable		Yes
	Barrel Material		Ni Plated Brass
	Sensor Face Material		Plastic (Ryton R-4)
PNP	NO	Cable	**C1A12AP1-M**
	NC	Cable	C1A12BP1-M
NPN	NO	Cable	C1A12AN1-M

Sensing Specifications

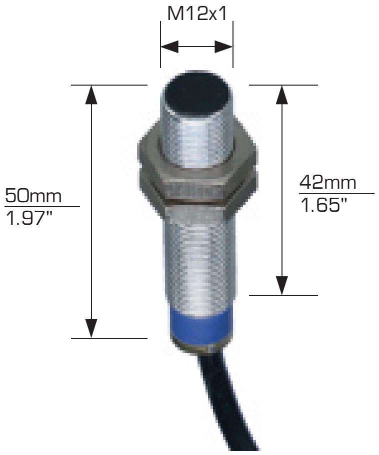
Nominal Sensing Distance-Sn	2.5mm (D-Type*)
Repeat Accuracy-(% of Sn)	<10%
Hysteresis-(% of Sn)	<20%
LED Indicator	Yellow When Output energized
Potentiometer	None

* D-Types will sense all materials. L-Types are best suited for **conductive** targets in standard and “look through” applications. See the Operating Principle section for a complete description.

DC Capacitive Proximity Sensors

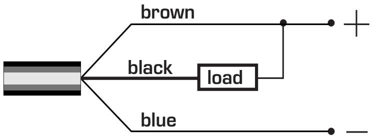
12mm Diameter Threaded Cylindrical

Mounting Dimensions

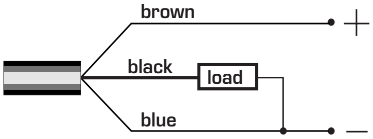


Wiring Diagrams

NPN, Current Sinking



PNP, Current Sourcing



Electrical Specifications

Supply Voltage	10-48 VDC
Continuous Switching Current	1...300 mA (500 mA @ <= 30 VDC)
Voltage Drop	<= 2 VDC
Leakage Current, mA	-
Current Consumption, mA	<= 10 mA
Switching Frequency, Max	100Hz
Transient Protection	2kV, 1ms, 1kOhm
Overload Protection	Standard
Short Circuit Protection	Standard
Reverse Polarity Protection	Standard

Notice

Connecting cables may be run in conduits with other DC control wiring, however, not in conduits with AC power wiring.

Mechanical Specifications

Enclosure Rating	IEC IP67 and NEMA 1,3,4,6,13
Operating Temperature, C	-25 to +70°
Shock	30g,11ms
Vibration	55Hz, 1mm amplitude in all 3 planes
LED Signal Indicator	Yellow when output energized
Potentiometer	No
Cable versions	2 meters PVC standard

DC Capacitive Proximity Sensors

18mm Diameter Threaded Cylindrical

Features

- Power and Signal LED Indicators
- Potentiometer for Sensitivity Adjustment
- 51.5mm Length
- Sealed to IP67
- Short circuit, overload and reverse polarity protection
- -25 to +70°C (-13 to 158°F)
- Cable and Connector versions
- Stainless Steel Versions Available

Part Numbers

	Service Class		Heavy Duty	Standard Duty	Standard Duty
	Sensor Type		D-Type*	D-Type*	L-Type*
	Flush Mountable		Yes	Yes	No
	Barrel Material		Stainless Steel	CrNi Plated Brass	Plastic (Ryton R-4)
	Sensor Face Mat'l		Plastic (Ryton R-4)	Plastic (Ryton R-4)	Plastic (Ryton R-4)
PNP	NO	Cable	C1A18AP1-S	**C1A18AP1-M**	C2A18AP1-P
		Connector	C1A18AP2-S	C1A18AP2-M	C2A18AP2-P
	NC	Cable	C1A18BP1-S	C1A18BP1-M	C2A18BP1-P
		Connector	C1A18BP2-S	C1A18BP2-M	C2A18BP2-P
NPN	NO	Cable	C1A18AN1-S	**C1A18AN1-M**	C2A18AN1-P
		Connector	C1A18AN2-S	C1A18AN2-M	C2A18AN2-P
	NC	Cable	C1A18BN1-S	C1A18BN1-M	C2A18BN1-P
		Connector	C1A18BN2-S	C1A18BN2-M	C2A18BN2-P

Sensing Specifications

Sensing Range	0-8mm
Nominal Sensing Distance-Sn	5mm
Repeat Accuracy-(% of Sn)	< 5%
Hysteresis-(% of Sn)	< 20%
LED Signal Indicator	Red when Output Energized
Power On LED Indicator	Green when powered
Potentiometer	15 Turn

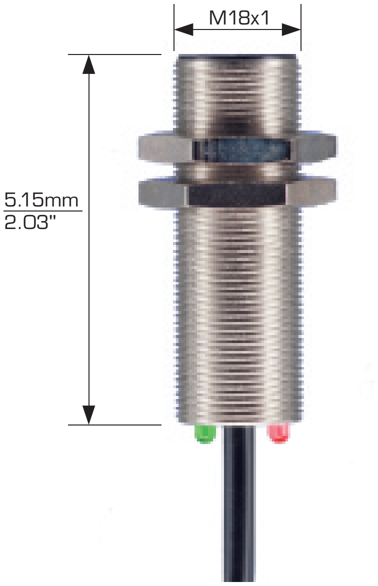
* D-Types will sense all materials. L-Types are best suited for **conductive** targets in standard and "look through" applications. See the Operating Principle section for a complete description.

DC Capacitive Proximity Sensors

18mm Diameter Threaded Cylindrical

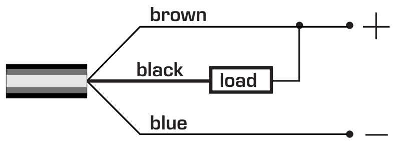
M 18mm DC

Mounting Dimensions

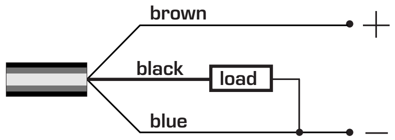


Wiring Diagrams

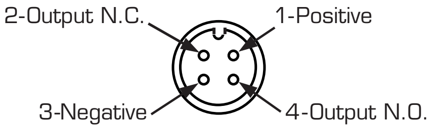
NPN, Current Sinking



PNP, Current Sourcing



DC 4-pin Micro, Standard Key



Note: N.O. Sensors - Term 2 no Conn
N.C. Sensors - Term 4 no Conn

Electrical Specifications

Supply Voltage	10-48 VDC
Continuous Switching Current	1...300 mA (500 mA @ <= 30 VDC)
Voltage Drop	<= 2 VDC
Leakage Current, mA	-
Current Consumption, mA	<= 10 mA
Switching Frequency, Max	100Hz
Transient Protection	2kV, 1ms, 1kOhm
Overload Protection	Standard
Short Circuit Protection	Standard
Reverse Polarity Protection	Standard

Notice

Connecting cables may be run in conduits with other DC control wiring, however, not in conduits with AC power wiring.

Mechanical Specifications

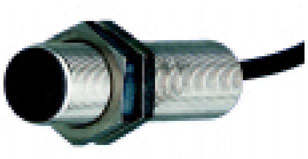
Enclosure Rating	IEC IP67 and NEMA 1,3,4,6,13
Operating Temperature, C	-25 to +70°
Shock	30g,11ms
Vibration	55Hz, 1mm amplitude in all 3 planes
LED Signal Indicator	Red when output energized
Power On LED Indicator	Green when powered
Potentiometer	15 Turn
Cable versions	2 meters PVC standard
Connector versions	12mm connector on .15 meter cable pigtail standard

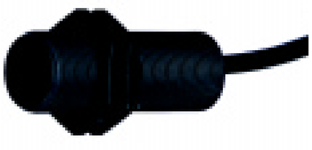
AC Capacitive Proximity Sensors

18mm Diameter Threaded Cylindrical

Features

- Large Voltage Range 24 - 240 VAC
- Power and Signal LED Indicators
- Potentiometer for Sensitivity Adjustment
- 51.5mm Length
- Sealed to IP67
- -25 to +70°C (-13 to 158°F)
- Cable and Connector versions
- Stainless Steel Versions Available





Part Numbers

Service Class		Heavy Duty	Standard Duty	Standard Duty
Sensor Type		D-Type*	D-Type*	L-Type*
Flush Mountable		Yes	Yes	No
Barrel Material		Stainless Steel	Ni Plated Brass	Plastic (Ryton R-4)
Sensor Face Mat'l		Plastic (Ryton R-4)	Plastic (Ryton R-4)	Plastic (Ryton R-4)
NO	Cable	C1A18AF1-S	**C1A18AF1-M**	C2A18AF1-P
	Connector	C1A18AF2-S	C1A18AF2-M	C2A18AF2-P
NC	Cable	C1A18BF1-S	C1A18BF1-M	C2A18BF1-P
	Connector	C1A18BF2-S	C1A18BF2-M	C2A18BF2-P

Sensing Specifications

Sensing Range	0-8mm
Nominal Sensing Distance-Sn	5mm
Repeat Accuracy-(% of Sn)	< 5%
Hysteresis-(% of Sn)	< 20%
LED Signal Indicator	Red when Output Energized
Power On LED Indicator	Green when powered
Potentiometer	15 Turn

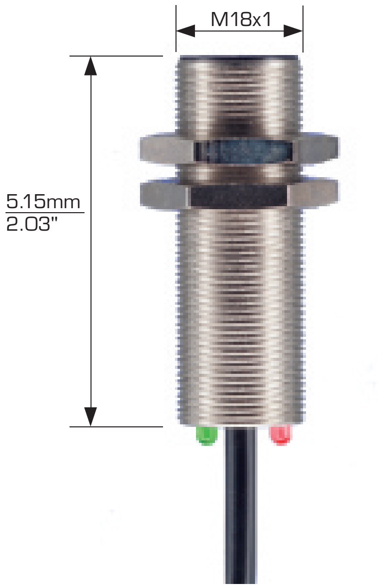
*D-Types will sense all materials. L-Types are best suited for c**onductive** targets in standard and "look through" applications. See the Operating Principle section for a complete description.

AC Capacitive Proximity Sensors

18mm Diameter Threaded Cylindrical

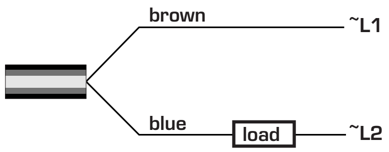
M 18mm AC

Mounting Dimensions

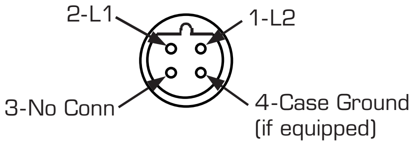


Wiring Diagrams

2-WIRE AC SENSORS



AC 4-PIN MICRO, INVERTED KEY



Notice

A load must be used when power is applied to AC sensors. Wiring without load will cause permanent unwarrantable damage.

Electrical Specifications

Supply Voltage	24 to 240 VAC
Continuous Switching Current	1...300 mA @ T < 70° C (158°F)
Continuous Switching Current	400 mA @ T < 50° C (122°F)
Continuous Switching Current	500 mA @ T < 25° C (77°F)
Voltage Drop	<= 7.5 VAC
Leakage Current	<= 1.5 mA
Current Consumption	-
Switching Frequency, Max	25Hz
Transient Protection	2kV, 1ms, 1kOhm

Mechanical Specifications

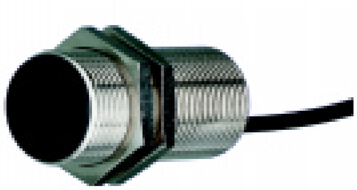
Enclosure Rating	IEC IP67 and NEMA 1,3,4,6,13
Operating Temperature, C	-25 to +70°
Shock	30g,11ms
Vibration	55Hz, 1mm amplitude in all 3 planes
LED Signal Indicator	Red when output energized
Power On LED Indicator	Green when powered
Potentiometer	15 Turn
Cable versions	2 meters PVC standard
Connector versions	12mm connector on .15 meter cable pigtail standard

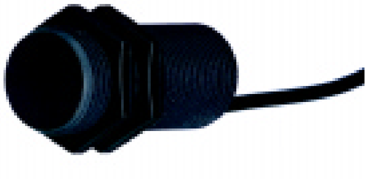
DC Capacitive Proximity Sensors

30mm Diameter Threaded Cylindrical

Features

- Power and Signal LED Indicators
- Potentiometer for Sensitivity Adjustment
- 51.5mm Length
- Sealed to IP67
- Short circuit, overload and reverse polarity protection
- -25 to +70°C (-13 to 158°F)
- Cable and Connector versions
- Stainless Steel Versions Available





Part Numbers

Service Class			Heavy Duty	Standard Duty	Standard Duty
Sensor Type			D-Type*	D-Type*	L-Type*
Flush Mountable			Yes	Yes	No
Barrel Material			Stainless Steel	Ni Plated Brass	Plastic (Ryton R-4)
Sensor Face Mat'l			Plastic (Ryton R-4)	Plastic (Ryton R-4)	Plastic (Ryton R-4)
PNP	NO	Cable	C1A30AP1-S	**C1A30AP1-M**	C2A30AP1-P
		Connector	C1A30AP2-S	C1A30AP2-M	C2A30AP2-P
	NC	Cable	C1A30BP1-S	C1A30BP1-M	C2A30BP1-P
		Connector	C1A30BP2-S	C1A30BP2-M	C2A30BP2-P
NPN	NO	Cable	C1A30AN1-S	**C1A30AN1-M**	C2A30AN1-P
		Connector	C1A30AN2-S	C1A30AN2-M	C2A30AN2-P
	NC	Cable	C1A30BN1-S	C1A30BN1-M	C2A30BN1-P
		Connector	C1A30BN2-S	C1A30BN2-M	C2A30BN2-P

Sensing Specifications

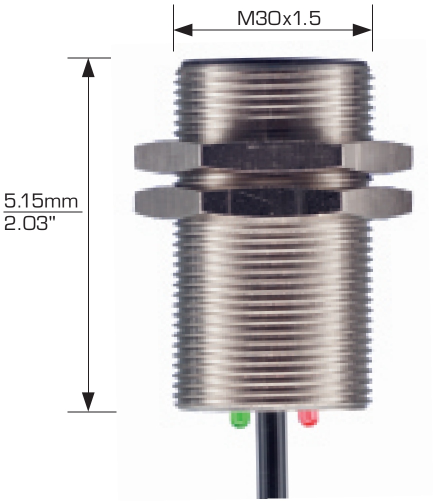
Sensing Range	0-15mm
Nominal Sensing Distance-Sn	10mm
Repeat Accuracy-(% of Sn)	< 5%
Hysteresis-(% of Sn)	< 20%
LED Signal Indicator	Red when Output Energized
Power On LED Indicator	Green when powered
Potentiometer	15 Turn

* D-Types will sense all materials. L-Types are best suited for **conductive** targets in standard and "look through" applications. See the Operating Principle section for a complete description.

DC Capacitive Proximity Sensors

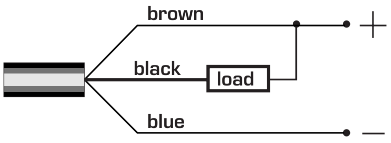
30mm Diameter Threaded Cylindrical

Mounting Dimensions

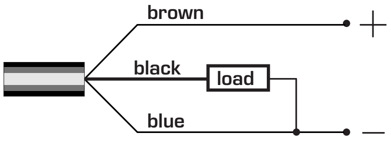


Wiring Diagrams

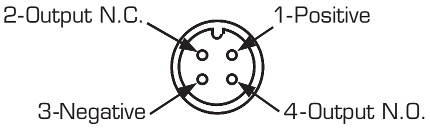
NPN, Current Sinking



PNP, Current Sourcing



DC 4-pin Micro, Standard Key



Note: N.O. Sensors - Term 2 no Conn
N.C. Sensors - Term 4 no Conn

Notice

Connecting cables may be run in conduits with other DC control wiring, however, not in conduits with AC power wiring.

Electrical Specifications

Supply Voltage	10-48 VDC
Continuous Switching Current	1...300 mA (500 mA @ <= 30 VDC)
Voltage Drop	<= 2 VDC
Leakage Current, mA	-
Current Consumption, mA	<= 10 mA
Switching Frequency, Max	100Hz
Transient Protection	2kV, 1ms, 1kOhm
Overload Protection	Standard
Short Circuit Protection	Standard
Reverse Polarity Protection	Standard

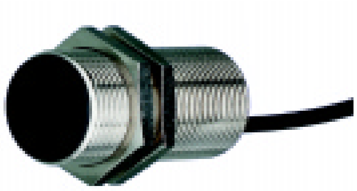
Mechanical Specifications

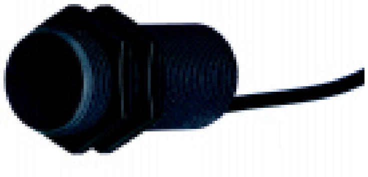
Enclosure Rating	IEC IP67 and NEMA 1,3,4,6,13
Operating Temperature, C	-25 to +70°
Shock	30g,11ms
Vibration	55Hz, 1mm amplitude in all 3 planes
LED Signal Indicator	Red when output energized
Power On LED Indicator	Green when powered
Potentiometer	15 Turn
Cable versions	2 meters PVC standard
Connector versions	12mm connector on .15 meter cable pigtail standard

AC Capacitive Proximity Sensors
30mm Diameter Threaded Cylindrical

Features

- Large Voltage Range 24 - 240 VAC
- Power and Signal LED Indicators
- Potentiometer for Sensitivity Adjustment
- 51.5mm Length
- Sealed to IP67
- -25 to +70°C (-13 to 158°F)
- Cable and Connector versions
- Stainless Steel Versions Available





Part Numbers

Service Class		Heavy Duty	Standard Duty	Standard Duty
Sensor Type		D-Type*	D-Type*	L-Type*
Flush Mountable		Yes	Yes	No
Barrel Material		Stainless Steel	Ni Plated Brass	Plastic (Ryton R-4)
Sensor Face Mat'l		Plastic (Ryton R-4)	Plastic (Ryton R-4)	Plastic (Ryton R-4)
NO	Cable	C1A30AF1-S	**C1A30AF1-M**	C2A30AF1-P
	Connector	C1A30AF2-S	C1A30AF2-M	C2A30AF2-P
NC	Cable	C1A30BF1-S	C1A30BF1-M	C2A30BF1-P
	Connector	C1A30BF2-S	C1A30BF2-M	C2A30BF2-P

Sensing Specifications

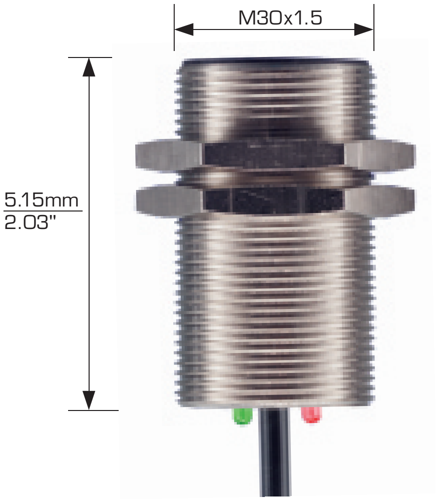
Sensing Range	0-15mm
Nominal Sensing Distance-Sn	10mm
Repeat Accuracy-(% of Sn)	< 5%
Hysteresis-(% of Sn)	< 20%
LED Signal Indicator	Red when Output Energized
Power On LED Indicator	Green when powered
Potentiometer	15 Turn

* D-Types will sense all materials. L-Types are best suited for **conductive** targets in standard and "look through" applications. See the Operating Principle section for a complete description.

AC Capacitive Proximity Sensors

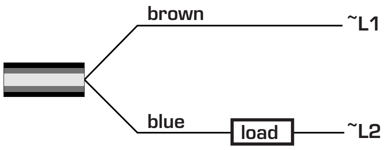
30mm Diameter Threaded Cylindrical

Mounting Dimensions

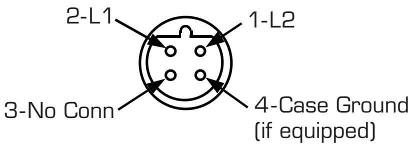


Wiring Diagrams

2-Wire AC Sensors



AC 4-pin Micro, Inverted Key



Notice

A load must be used when power is applied to AC sensors. Wiring without load will cause permanent unwarrantable damage.

Electrical Specifications

Supply Voltage	24 to 240 VAC
Continuous Switching Current	1...300 mA @ T < 70° C (158°F)
Continuous Switching Current	400 mA @ T < 50° C (122°F)
Continuous Switching Current	500 mA @ T < 25° C (77°F)
Voltage Drop	<= 7.5 VAC
Leakage Current	<= 1.5 mA
Current Consumption	-
Switching Frequency, Max	25Hz
Transient Protection	2kV, 1ms, 1kOhm

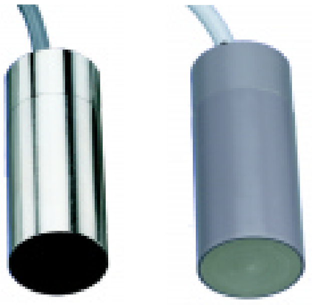
Mechanical Specifications

Enclosure Rating	IEC IP67 and NEMA 1,3,4,6,13
Operating Temperature, C	-25 to +70°
Shock	30g,11ms
Vibration	55Hz, 1mm amplitude in all 3 planes
LED Signal Indicator	Red when output energized
Power On LED Indicator	Green when powered
Potentiometer	15 Turn
Cable versions	2 meters PVC standard
Connector versions	12mm connector on .15 meter cable pigtail standard

DC Capacitive Proximity Sensors
32mm Diameter Smooth Case Cylindrical

Features

- Extended Sensing Distance
- Signal LED Indicator
- Potentiometer for Sensitivity Adjustment
- Short circuit, overload and reverse polarity protection
- -25 to +70°C (-13 to 158°F)



Part Numbers

	Sensor Type		D-Type*	L-Type*
	Flush Mountable		Yes	No
	Barrel Material		Ni Plated Brass	Plastic
	Sensor Face Mat'l		FR4 Epoxy	Plastic
PNP	NO	Cable	(C1B32AP1-M)	(C2B32AP1-P)
	NC	Cable	(C1B32BP1-M)	(C2B32BP1-P)
NPN	NO	Cable	(C1B32AN1-M)	(C2B32AN1-P)
	NC	Cable	(C1B32BN1-M)	(C2B32BN1-P)

Sensing Specifications

Sensing Range	0-20mm
Nominal Sensing Distance-Sn	15mm
Repeat Accuracy-(% of Sr)	< 10%
Hysteresis-(% of Sr)	< 20%
LED Signal Indicator	Yellow when Output Energized
Potentiometer	15 Turn

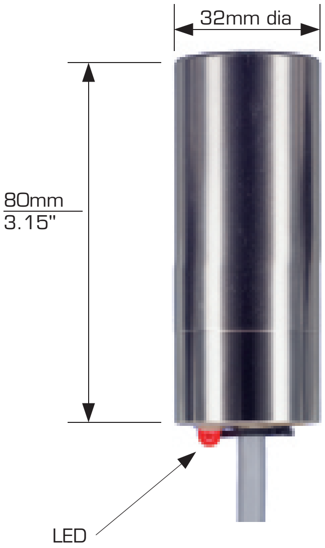
* D-Types will sense all materials. L-Types are best suited for **conductive** targets in standard and "look through" applications. See the Operating Principle section for a complete description.

DC Capacitive Proximity Sensors

32mm Diameter Smooth Case Cylindrical

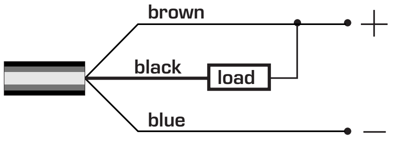
Ø 32mm DC

Mounting Dimensions

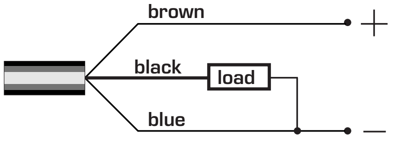


Wiring Diagrams

NPN, Current Sinking



PNP, Current Sourcing



Electrical Specifications

Supply Voltage	10-48 VDC
Continuous Switching Current	1...300 mA (500 mA @ <= 30 VDC)
Voltage Drop	<= 2 VDC
Leakage Current, mA	-
Current Consumption, mA	<= 10 mA
Switching Frequency, Max	100Hz
Transient Protection	2kV, 1ms, 1kOhm
Overload Protection	Standard
Short Circuit Protection	Standard
Reverse Polarity Protection	Standard

Notice

Connecting cables may be run in conduits with other DC control wiring, however, not in conduits with AC power wiring.

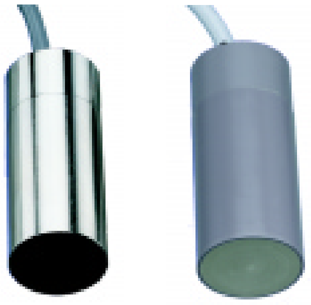
Mechanical Specifications

Enclosure Rating	IEC IP67 and NEMA 1,3,4,6,13
Operating Temperature, C	-25 to +70°
Shock	30g,11ms
Vibration	55Hz, 1mm amplitude in all 3 planes
LED Signal Indicator	Yellow when output energized
Potentiometer	15 Turn
Cable versions	2 meters PVC standard

AC Capacitive Proximity Sensors
32mm Diameter Smooth Case Cylindrical

Features

- Extended Sensing Range
- Large Voltage Range 24 - 240 VAC
- Signal LED Indicator
- Potentiometer for Sensitivity Adjustment
- -25 to +70°C (-13 to 158°F)



Part Numbers

Sensor Type		D-Type*	L-Type*
Flush Mountable		Yes	No
Barrel Material		Ni Plated Brass	Plastic
Sensor Face Mat'l		FR4 Epoxy	Plastic
NO	Cable	(C1B32AF1-M)	(C2B32AF1-P)
NC	Cable	(C1B32BF1-M)	(C2B32BF1-P)

Ø 32mm AC

Sensing Specifications

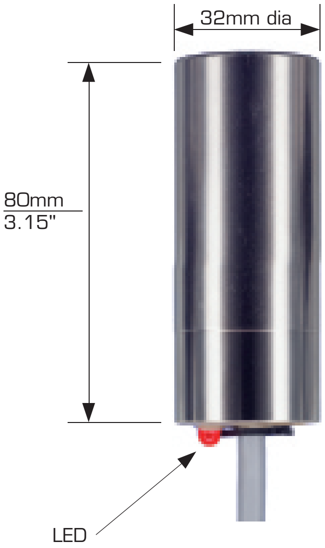
Sensing Range	0-20mm
Nominal Sensing Distance-Sn	15mm
Repeat Accuracy-(% of Sr)	< 10%
Hysteresis-(% of Sr)	< 20%
LED Signal Indicator	Yellow when Output Energized
Potentiometer	15 Turn

* D-Types will sense all materials. L-Types are best suited for **conductive** targets in standard and "look through" applications. See the Operating Principle section for a complete description.

AC Capacitive Proximity Sensors

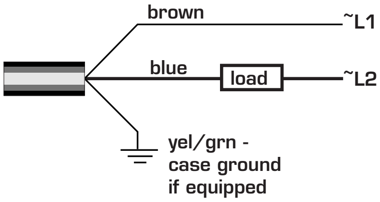
32mm Diameter Smooth Case Cylindrical

Mounting Dimensions



Wiring Diagrams

2-WIRE AC SENSORS



Notice

Connecting cables may be run in conduits with other DC control wiring, however, not in conduits with AC power wiring.

Electrical Specifications

Supply Voltage	24 to 240 VAC
Continuous Switching Current	1...300 mA
Voltage Drop	<= 7.5 VAC
Leakage Current	<= 1.5 mA
Current Consumption	-
Switching Frequency, Max	25Hz
Transient Protection	2kV, 1ms, 1kOhm

Mechanical Specifications

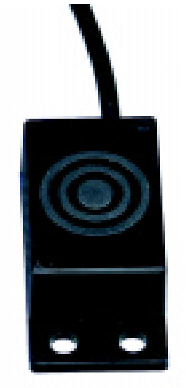
Enclosure Rating	IEC IP67 and NEMA 1,3,4,6,13
Operating Temperature, C	-25 to +70°
Shock	30g,11ms
Vibration	55Hz, 1mm amplitude in all 3 planes
LED Signal Indicator	Yellow when output energized
Potentiometer	15 Turn
Cable versions	2 meters PVC standard

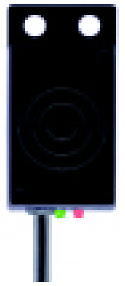
DC Capacitive Proximity Sensors

30x45mm FlatPack

Features

- Extended Sensing Distance
- Power and Signal LED Indicators
- Potentiometer for Sensitivity Adjustment
- Short circuit, overload and reverse polarity protection
- -25 to +70°C (-13 to 158°F)
- Cable and Connector versions
- Easy Mounting





Part Numbers

	Sensor Type		D-Type*	L-Type*
	Flush Mountable		No	No
	Housing Material		Plastic	Plastic
PNP	NO	Cable	**C1D45AP1-P**	C2D45AP1-P
		Connector	C1D45AP2-P	C2D45AP2-P
	NC	Cable	C1D45BP1-P	C2D45BP1-P
		Connector	C1D45BP2-P	C2D45BP2-P
NPN	NO	Cable	**C1D45AN1-P**	C2D45AN1-P
		Connector	C1D45AN2-P	C2D45AN2-P
	NC	Cable	C1D45BN1-P	C2D45BN1-P
		Connector	C1D45BN2-P	C2D45BN2-P

* D-Types will sense all materials. L-Types are best suited for **conductive** targets in standard and "look through" applications. See the Operating Principle section for a complete description.

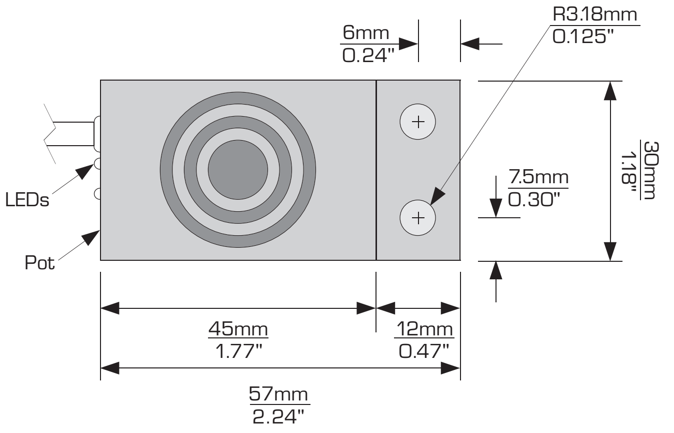
Sensing Specifications

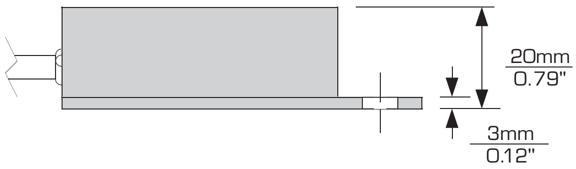
Sensing Range	5-25mm
Nominal Sensing Distance-Sn	20mm
Repeat Accuracy-(% of Sr)	< 5%
Hysteresis-(% of Sr)	< 20%
LED Signal Indicator	Red when Output Energized
Power On LED Indicator	Green when powered
Potentiometer	15 Turn

DC Capacitive Proximity Sensors

30x45mm FlatPack

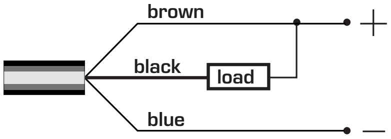
Mounting Dimensions



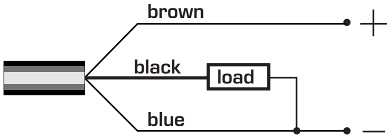


Wiring Diagrams

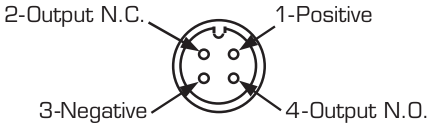
NPN, CURRENT SINKING



PNP, CURRENT SOURCING



DC 4-PIN MICRO, STANDARD KEY



Note: N.O. Sensors - Term 2 no Conn
N.C. Sensors - Term 4 no Conn

Notice

Connecting cables may be run in conduits with other DC control wiring, however, not in conduits with AC power wiring.

Electrical Specifications

Supply Voltage	10-48 VDC
Continuous Switching Current	1...300 mA (500 mA @ <= 30 VDC)
Voltage Drop	<= 2 VDC
Leakage Current, mA	-
Current Consumption, mA	<= 10 mA
Switching Frequency, Max	100Hz
Transient Protection	2kV, 1ms, 1kOhm
Overload Protection	Standard
Short Circuit Protection	Standard
Reverse Polarity Protection	Standard

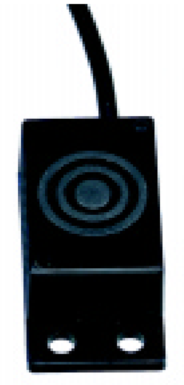
Mechanical Specifications

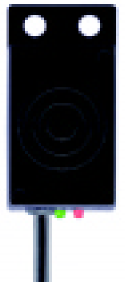
Enclosure Rating	IEC IP67 and NEMA 1,3,4,6,13
Operating Temperature, C	-25 to +70°
Shock	30g,11ms
Vibration	55Hz, 1mm amplitude in all 3 planes
LED Signal Indicator	Red when output energized
Power On LED Indicator	Green when powered
Potentiometer	15 Turn
Cable versions	2 meters PVC standard
Connector versions	12mm connector on .15 meter cable pigtail standard

AC Capacitive Proximity Sensors
30x45mm FlatPack

Features

- Extended Sensing Distance
- Power and Signal LED Indicators
- Potentiometer for Sensitivity Adjustment
- Short circuit, overload and reverse polarity protection
- -25 to +70°C (-13 to 158°F)
- Cable and Connector versions
- Easy Mounting





Part Numbers

Sensor Type		D-Type*	L-Type*
Flush Mountable		No	No
Housing Material		Plastic	Plastic
NO	Cable	**C1D45AF1-P**	C2D45AF1-P
	Connector	C1D45AF2-P	C2D45AF2-P
NC	Cable	C1D45BF1-P	C2D45BF1-P
	Connector	C1D45BF2-P	C2D45BF2-P

* D-Types will sense all materials. L-Types are best suited for **conductive** targets in standard and "look through" applications. See the Operating Principle section for a complete description.

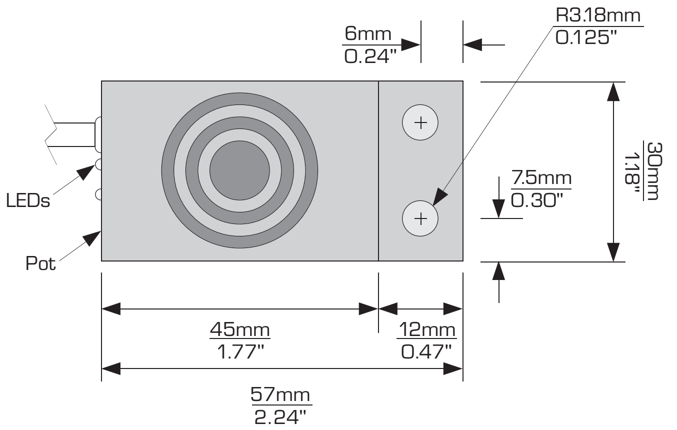
Sensing Specifications

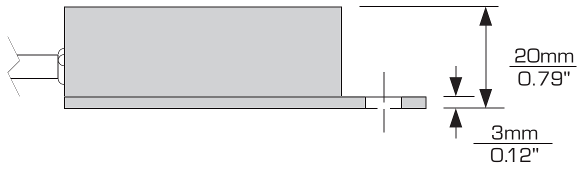
Sensing Range	5-25mm
Nominal Sensing Distance-Sn	20mm
Repeat Accuracy-(% of Sr)	< 5%
Hysteresis-(% of Sr)	< 20%
LED Signal Indicator	Red when Output Energized
Power On LED Indicator	Green when powered
Potentiometer	15 Turn

AC Capacitive Proximity Sensors

30x45mm FlatPack

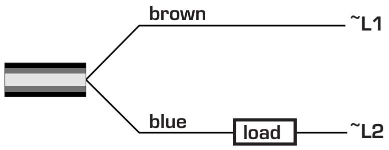
Mounting Dimensions



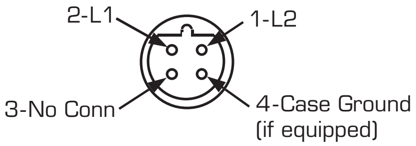


Wiring Diagrams

2-WIRE AC SENSORS



AC 4-PIN MICRO, INVERTED KEY



Notice

A load must be used when power is applied to AC sensors. Wiring without load will cause permanent unwarrantable damage.

Electrical Specifications

Supply Voltage	24 to 240 VAC
Continuous Switching Current	1...300 mA @ T < 70° C (158°F)
Continuous Switching Current	400 mA @ T < 50° C (122°F)
Continuous Switching Current	500 mA @ T < 25° C (77°F)
Voltage Drop	<= 7.5 VAC
Leakage Current	<= 1.5 mA
Current Consumption	-
Switching Frequency, Max	25Hz
Transient Protection	2kV, 1ms, 1kOhm

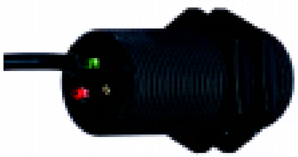
Mechanical Specifications

Enclosure Rating	IEC IP67 and NEMA 1,3,4,6,13
Operating Temperature, C	-25 to +70°
Shock	30g,11ms
Vibration	55Hz, 1mm amplitude in all 3 planes
LED Signal Indicator	Red when output energized
Power On LED Indicator	Green when powered
Potentiometer	15 Turn
Cable versions	2 meters PVC standard
Connector versions	12mm connector on .15 meter cable pigtail standard

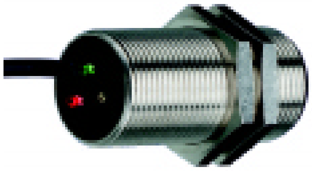
Analog Output

Capacitive Proximity Sensors

C2A30SV1-P
3 Wire 15-24 VDC Supply
0-10VDC Output



C1A30SV1-M
3 Wire 15-24 VDC Supply
0-10VDC Output



0-15mm Range

M 30mm

C2D45SV1-P
3 Wire 15-24 VDC Supply
0-10VDC Output

5-30mm Range

FlatPack

Notes

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